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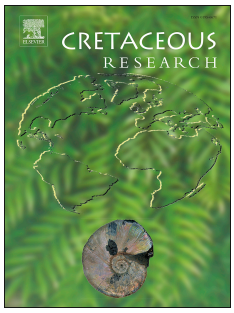

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New evanioid wasps (Hymenoptera: Praeaulacidae, Aulacidae) from Cenomanian Burmese amber

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ABSTRACT

The Cenomanian amber from Kachin State of Myanmar contains a diversified fauna of fossil evanioid wasps. Two new genera are described and figured, as *Rasnitsevania ferox* gen. et sp. nov. in the family Praeaulacidae, and *Electrofoenia jehani* gen. et sp. nov. in Aulacidae. Characteristic features of *Rasnitsevania* gen. nov. include a large mesosoma, a two-segmented metasomal petiole with first segment long, trapezoidal, and the fore wing venation with a long cell 1-mcu and a cell 2rm shorter than 3rm. *Electrofoenia* is characterized by the pronotum transversely striate and the fore wing with vein 1Rs less than twice as long as 2Rs, 2Rs+M short, 2M longer than 3M, and 1cu-a basal to fork of 1M and 1cu. The Praeaulacidae and Aulacidae display an extensive fossil record suggesting that the Mesozoic Evanioidea were much more diverse than today. An updated list of the fossil record of the Praeaulacidae is provided.

Keywords. Hymenoptera, Evanioidea, Praeaulacidae, Aulacidae, Cenomanian, fossil record

1. Introduction

The Evanioidea comprises the extant families Evaniidae, Aulacidae, Gasteruptiidae, and the Mesozoic families †Praeaulacidae (including Nevaniinae, see below), †Anomopterellidae, †Andreneliidae, †Baissidae, and †Othniodellithidae (following the classification of Li et al., 2018). Evanioid wasps are easily recognizable by their articulation of the metasoma located high on the propodeum and well above the metacoxae (Goulet and Huber, 1993). Their relatively rich fossil record suggests that their diversity was higher during the Mesozoic than in the extant ecosystems in which they are rivaled by the hyperdiverse Ichneumonoidea, Chalcidoidea or Platygastroidea. The extant Evanioidea comprises approximately 1,200 described species contra more than 24,000 species for the hyperdiverse Ichneumonoidea (Huber, 2009; Yu et al., 2011; Engel and Krombein, 2012; Zhao et al., 2012; Aguiar et al., 2013; Jennings et al., 2018). Extant taxa are predators or ectoparasites of roaches, aculeate wasps, or bees, and endoparasites of xylophagous insects (Huben, 1995; Jennings and Austin, 2004; Turrisi and Vilhelmsen, 2010).

Molecular and morphological studies strongly support the monophyly of the Evanioidea (Dowton and Austin, 1994; Dowton et al., 1997; Vilhelmsen et al., 2010; Heraty et al., 2011; Sharkey et al., 2012; Klopfstein et al., 2013; Payne et al., 2013; Li et al., 2018). And the monophyly of its constituent families are also well supported, e.g., Aulacidae (Jennings and Austin, 2000; Smith, 2001; Turrisi, 2006, 2007, 2014; Turrisi et al., 2009; Turrisi and Madl, 2013), Gasteruptiidae (Jennings and Austin, 2002; Macedo, 2009, 2011; Zhao et al., 2012; van Achterberg and Talebi, 2014), Evaniidae (Deans and Huben, 2003; Deans, 2005; Deans et al., 2006; Kawada and Azevedo, 2007; Mullins et al., 2012).

Considered as the ‘ancestral’ group of Evanioidea, the Praeaulacidae is an extinct family composed of three subfamilies (Table 1) and characterized by a more complete wing venation, except for some species of the subfamily Cretocleistogastrinae (Rasnitsyn, 1988; Li

et al., 2013). The Nevaniinae have been considered a family (Nevaniidae) by Engel et al. (2016), Engel (2017), and Turrisi and Ellenberger (2019), however without any clear justification. Its two constituant genera *Nevania* and *Eonevania* were retrieved nested within the Praeaulacidae in the phylogenetic analysis of the Evanioidea by Li et al. (2018), hence the present treatment of this lineage as a subfamily rather than a family. The Aulacidae comprise extant and fossil species, distributed in two subfamilies Hyptiogastritinae (Engel, 2006, 2017) and Aulacinae (Shuckard, 1841).

Fossil Evanioidea are rather common and known from rock imprints and amber inclusions. The latter are especially frequent during the Cretaceous with occurrences in amber from the Barremian of Lebanon (Deans et al., 2004; Basibuyuk et al., 2002), Albian of Spain (Peñalver et al., 2010; Pérez-de la Fuente et al., 2012), Cenomanian of Myanmar (Cockerell, 1917a, 1917b; Basibuyuk et al., 2000a; Engel, 2006, 2017; Jennings et al., 2004, 2013; Li et al., 2013, 2015, 2018; Engel and Wang, 2016; Engel et al., 2016; Shih et al., 2019; Turrisi and Ellenberger, 2019) and Russia (Rasnitsyn, 1975), Turonian of the USA (Basibuyuk et al., 2000b; Engel, 2006, 2013), and Santonian of Russia (Rasnitsyn, 1975).

Here we focus on the highly fossiliferous Burmese amber from Kachin, northern Myanmar, also called “burmite”. It has been exploited by Chinese jewelry industries since at least two millenia. It is only about a century ago that this amber was studied scientifically for the first time (Cockerell, 1916a, 1916b, 1917a, 1917b, 1920a, 1920b; Burn, 1918). This resin is renowned for its well-preserved and plethoric inclusions of plants, arthropods and other invertebrate and vertebrate organisms. The main source for this material is the site of the “Noije Bum hill”. Recently a strong craze around the study of this amber, linked to an increasing availability of material, has allowed for the description of many new taxa including evanioid wasps (Ross, 2019). We found two new genera and species, that we describe herein in Praeaulacidae and Aulacidae, respectively.

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2. Material and methods

The two amber pieces containing the specimens studied herein derive from the deposits of Noije Bum in the Hukawng Valley (26° 29′ N, 96° 35′ E), Kachin State, northern Myanmar (see detailed map in Grimaldi and Ross, 2017: fig. 2). Radiometric data established an Early Cenomanian age (98.79 ± 0.62 Ma) for Kachin amber, based on zircons from volcanic clasts found within the amber-bearing sediments (Shi et al., 2012). Some ammonites found in the amber-bearing bed and within amber corroborates a Late Albian / Early Cenomanian age (Cruickshank and Ko, 2003; Yu et al., 2019).

The new praeaulacid specimen is embedded in a piece of dark orange amber with a moss in syninclusion. It is a nearly complete individual but with the gaster torn apart and moved perpendicularly to the body axis, with apical metasomal segment missing. The Aulacidae is nearly complete, missing only the apical flagellomere on both antennae, and is distinctly compressed laterally. It is embedded in a piece of clear yellow amber. Both type specimens are housed in the amber collection of the Geological Department and Museum of the University of Rennes, France (IGR). The specimens were examined with a Leica MZ APO stereomicroscope. Photographs were made using a Zeiss Axio Zoom.V16 stereomicroscope and Axiocam 512 digital camera with Zen software allowing for measurements and digital photography. All images are digitally stacked photomicrographic composites of several individual focal planes, which were obtained using HeliconFocus. The figures were composed with Adobe Illustrator and Photoshop softwares. The wing venation terminology follows Li et al. (2015) for the Praeaulacidae and Engel (2017) for the Aulacidae.

3. Systematic paleontology

Order Hymenoptera Linnaeus, 1758

Suborder Apocrita Gerstaecker, 1867

Superfamily Evanioidea Latreille, 1802

Family †Praeaulacidae Rasnitsyn, 1972

Subfamily †Nevaniinae Zhang & Rasnitsyn, 2007

Genus ***Rasnitsevania*** Jouault, Nel & Perrichot, gen. nov.

urn:lsid:zoobank.org:act:AFE2DEC6-07DA-4C87-A919-DC1F9CE2B9C5

Type species: *Rasnitsevania ferox* Jouault, Nel & Perrichot, sp. nov.

Etymology. The new genus-group name combines a patronym for Prof. Alexandr Rasnitsyn, eminent Russian hymenopterist, and the suffix 'evania' which is commonly used for evanioid genera. Gender feminine.

Diagnosis. Medium-sized (body about 7 mm in length). Antenna 31-segmented. Mesosoma longer than high. Mesocoxa much closer to metacoxa than to procoxa. Fore wing with 10 closed cells; pterostigma narrow basally, gradually widening distally until meeting with 2r-rs at 1/3 of pterostigmal length; 1-Rs shorter than 1-M, both veins nearly aligned and slightly longer than M+Cu when combined, 1-Rs meeting R just before pterostigma; Rs nearly straight beyond 2r-rs; 2r-rs longer than maximal width of cell 2rm; 2m-cu slightly distad of 2r-m; cu-a interstitial or slightly postfurcal; cell 2cua distinctly longer than wide; 2rm smaller than 3rm; 2cua much smaller than 2mcu. Hind wing venation complete with C tubular; cells R, Cu and R longer than wide; vein Rs not reaching wing margin. Metasomal petiole bi-

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segmented; first petiolar segment about half as long as second petiolar segment; remaining metasoma as long or slightly longer than first and second segments combined.

Rasnitsevania ferox Jouault, Nel & Perrichot, sp. nov.

urn:lsid:zoobank.org:act:C3719820-1657-4562-8553-0F6F3CF4A47B

(Figs. 1–3)

Material. Holotype, sex unknown, accession number IGR.BU-005, preserved in a rectangular piece of amber measuring 13 × 11 × 6 mm.

Locality and horizon. Noije Bum Hill, Hukawng Valley, Kachin State, Myanmar; lower Cenomanian, Upper Cretaceous.

Etymology. The specific epithet derives from the Latin *ferox*, meaning "fierce", in reference to its general fierce aspect.

Diagnosis. As for the genus.

Description. Head large (Figs. 1, 2A, 2B and 3A), about as width as long; posterior margin developed. Eyes wide, elongate ovoid; three ocelli visible on the third part of the head between eyes. Antenna inserted far above mandibles (at level of mid-length of eyes), almost as long as head and mesosoma combined, with 31 antennomeres. In frontal view, scape nearly as broad as long (in width and maximal length), trapezoidal (thinner at the base and larger at the top); pedicel narrower than scape distally, and about as long as wide; first flagellomere cylindrical, as wide as pedicel, and as long as scape; following flagellomeres progressively decreasing in length, longer than broad or at most as long as broad. Mandibles stout, with four sharp teeth; apical tooth longest. Palp formula at least 5-4.

Mesosoma stout (Figs. 1, 2A and 2C). Pronotum comparatively short, anterior margin developed. Mesonotum with notauli distinct. Mesopleuron slightly convex. Propodeum

rounded dorsally and laterally. Fore leg thin and short. Mid-leg shorter than fore leg. Metacoxa longer than mesocoxa; metatrochanter nearly as long as metacoxa; metafemur elongate, slightly swollen medially; metatibia thin, about as long as metafemur; combined length of metatarsomeres about 2/3 length of metatibia. Tibial spur formula ?1/2/2; one of the hind tibial spurs longer than the other.

Fore wing (Figs. 2C and 3B) well-preserved but partly folded; veins C, R, M+Cu and A present, with M+Cu fork closer to wing base than to pterostigma; Rs and M reaching wing margin; 1rm elongate, as long as combined lengths of 1cua and 2cua; 1-M 1.5 times as long as 1RS; 1Rs and 1-M nearly straight and aligned; 2cua broader than 1cua but nearly twice as short; M+Cu and 1Cu aligned; 2mcu slightly longer than wide; 2-Cu curved; 2r-rs oblique, meeting pterostigma in its basal third, and three times as long as pterostigmal width; 2cua 0.8 times shorter than 2mcu; 3r long and 1.6-1.7 times as long as 1+2r; 2rm and 1mcu in contact; 2rm 2.7 times shorter than 1+2r and 4.5 times shorter than 3r; 2rm 0.7 times shorter than 3rm; 3r-m slightly longer than 2r-m; cu-a slightly postfurcal and nearly straight. Hind wing (Fig. 3B) well-preserved but hidden under fore wing, with clear and discernible venation. Veins C, R, M+Cu and A present, Rs not reaching wing margin; r-m 0.6 times as short as first abscissa of Rs; first abscissa of M sub-equal to r-m; Cu and cu-a veins meeting into a ghost vein; cells R, Rs and A opened.

Metasoma. First and second metasomal segments trapezoid in dorsal view, their maximal width subequal (Fig. 2C); first segment nearly twice as long as broad; second segment about twice as long as first segment; remaining preserved segments (3 to 6) only slightly longer than first and second segments combined; tergite 3 slightly longer than tergite 2, following tergites progressively decreasing in length; tergite 7 torn apart, incomplete; metasomal apex missing.

Measurements (in mm): head width 1.8-2.0; head length 1.6 (without mandibles); antennal length (as preserved) 6.5–7; mesosomal length from pronotal margin to petiolar insertion 2.7;

fore wing length 4.6, width (as preserved) 1.6; length of first and second metasomal segments 0.6 and 1.2, combined length of remaining segments (3 to 6) 2.0.

Remarks. Rasnitsevania gen. nov. is assigned to the Praeaulacidae based on the hind wing venation with Rs, r-m and cu-a present (only R, M+Cu and A are present in other Evanioidea, except in the Othniodellithidae) and the numerous antennomeres (31 versus at most 26 antennomeres in other Evanioidea). It is excluded from Othniodellithidae for the absence of cephalic horn and the distinct fore wing venation (Engel et al., 2016; Engel, 2017).

Within the Praeaulacidae, *Rasnitsevania* gen. nov. has the characteristics of Nevaniinae as defined by Zhang and Rasnitsyn (2007), *viz*. a two-segmented petiole and the vein M+Cu shorter than 1-Rs & 1-M combined. *Rasnitsevania* gen. nov. can be easily distinguished from the two other nevaniine genera by the first petiolar segment that is twice as short as the second segment (both segments are subequal in *Nevania* and *Eonevania*). *Rasnitsevania* gen. nov. also differs from *Nevania* by its petiole trapezoidal rather than tube-like; its fore wing cell 2rm more than twice as short as 3rm (vs. 2rm as long as or longer than 3rm); its vein 2r-m about twice as short as 3r-m (vs. slightly shorter); its vein 2r-rs sub-equal to 1-Rs (vs. 2r-rs shorter than 1-Rs); its vein 2-Rs shorter than Rs+M (vs. sub-equal); its cell 1m-cu separated from 2rm by a conspicuous vein 2-M (absent in *Nevania*); and its hind wing with vein 1-Cu present (vs. absent).

Rasnitsevania gen. nov. additionally differs from *Eonevania* by its fore wing with cell 2rm more than twice as short as 3rm (vs. 2rm slightly shorter than 3rm), the vein 3r-m oblique and straight (vs. vertical and curved medially), the vein 2r-rs branching out before the mid-length of pterostigma (vs. at mid-length of pterostigma); and the vein 2A absent (vs. present and complete).

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Key to the genera of Nevaniinae:

1. First petiolar segment sub-equal or slightly shorter than second petiolar segment; fore wing cell 2rm slightly shorter, sub-equal or longer than 3rm …… 2

– First petiolar segment twice as short as second petiolar segment; fore wing cell 2rm twice as short as 3rm …… *Rasnitsevania* gen. nov.

2. Petiolar segment tubular; fore wing cell 2rm as long as or longer than 3rm …….

……..….. *Nevania* Zhang & Rasnitsyn, 2007

– Petiolar segment trapezoidal; fore wing cell 2rm slightly shorter than 3rm …….

……... *Eonevania* Rasnitsyn & Zhang, 2010

Family Aulacidae Shuckard, 1841

Subfamily Aulacinae Shuckard, 1841

Tribe Electrofoenini Cockerell, 1917

Genus ***Electrofoenia*** Jouault, Nel & Perrichot, gen. nov.

urn:lsid:zoobank.org:act:6B8A8F04-FA68-43DC-8EC7-60CCB9E0FB9A

Type species: *Electrofoenia jehani* Jouault, Nel & Perrichot, sp. nov.

Etymology. The new genus-group name is a combination of the Greek word *elektron* (meaning, 'amber') and the suffix '*foenia*', which is commonly used for the aulacid genera. Gender feminine.

Diagnosis. The new genus differs from other electrofoenine gerera in the pronotum transversely striate; the fore wing with vein 1Rs less than twice as long as 2Rs; 1M and 1m-cu nearly half as long as 1Rs; and 2Rs+M short, not surpassing base of pterostigma.

Electrofoenia jehani Jouault, Nel & Perrichot, sp. nov.

urn:lsid:zoobank.org:act:566B2187-B68B-4D1C-B5D5-75B9B0C8FF0C

(Fig. 4)

Material. Holotype male, accession number IGR.BU-006; preserved in a rounded piece of amber measuring 10.5 × 2 mm.

Locality and horizon. Noije Bum Hill, Hukawng Valley, Kachin State, Myanmar; lower Cenomanian, Upper Cretaceous.

Etymology. The specific epithet is a patronym honoring Fabrice Jehan, a former biology teacher of one of us (JC).

Diagnosis. As for the genus.

Description. Head apparently longer than wide (but evidently distorted in full-face view); occipital carina complete; malar space narrow, shorter than basal mandibular width; compound eye large, prominent, slightly ovoid, without circum-ocular carina, inner margins parallel; ocelli forming a small triangle (but distorted by preservation) positioned on top of vertex above dorsal margin of compound eyes. Antennal toruli broadly separated, situated near base of clypeus and at lower tangent of compound eyes; scape robust, longer than pedicel, longer than or sub-equal to first flagellomere; flagellum filiform, with 10 preserved flagellomeres all longer than wide except flagellomere 10 which is slightly longer than first one. Clypeus short; mandibles projecting, bidentate, apical tooth longest; outer margin of mandibles arched inward in apical half.

Mesosoma longer than high; pronotum distinctly striate transversely (Fig. 4A), without defined, raised posterior dorsal surface bordering mesoscutum, with posterior border broadly concave, lateral surfaces large; mesoscutum with prominent carina along anterior border;

mesopleuron short. Legs long, with slender podites; tibial spur formula 1-2-2; protrochantellus distinct but fused to associated femora; metatrochantellus present but somewhat indistinct; metabasitarsus elongate and longer than combined lengths of remaining tarsomeres; pretarsal claws small, simple; arolium minute.

Fore wing (Fig. 4B) with costal space slightly narrower than pterostigma; pterostigma longer than wide, broadest after midlength, tapering gradually to apex; r-rs originating slightly distad of pterostigmal midlength; veins 1M and 1m-cu relatively long, about half as long as 1Rs; 1Rs+M nearly twice as long as 2Rs+M; 2Rs arched apically; rs-m phantom-like; cell 1Rs longer than 1R1; lm-cu subequal to 1M; 2m-cu meeting 1Rs slightly apical to mid length (vein 2M longer than 3M); cell lCu basad M+Cu fork, thus short 2M+Cu present prior to bifurcation of veins 1M and 1Cu. Hind wing with C+R the only visible vein.

Metasoma elongate in profile, cylindrical, longer than mesosoma; first metasomal segment (petiole) cone shaped, short; following segments not easily distinguishable from each other by preservation. Parameres directed ventrally, keel-shaped, about as high as apical metasomal segment. Aedegus partly exposed, with acute tip.

Measurements (in mm). Total length as preserved (excluding antennae) 3.4; head length (excl. mandibles) 0.8; compound eye 0.4 long, 0.2 wide; mesosomal length 1.0, maximum height 0.5-0.6; dorsal length of propodeum (between metanotum and petiolar insertion) 0.3; metasomal length 2.1; metafemur length 1.1, metatibial length 0.9; metabasitarsus length 0.5, lengths of remaining tarsomeres (from base to apex), 0.15 / 0.1 / 0.05 / 0.05; fore wing length 3.0.

Remarks. Electrofoenia gen. nov. is assigned to the Aulacidae based on the elbowed antennae with 10 flagellomeres (antennae filiform in Baissidae, with more than 20 flagellomeres in Praeaulacidae, 18-19 flagellomeres in Othniodellithidae, and at least 16

flagellomeres in Anomopterillidae). It also differs from Othniodellithidae by the absence of cephalic horn and the shorter scape; and from Baissidae by its propleuron extending forward to form a pronounced 'neck' (neck absent in Baissidae). Within Aulacidae, the new genus differs from the Hyptiogastritinae by a more complete fore wing venation with the veins rs-m and 2m-cu present. The complete occipital carina, mandibles elongate and projected forward, wing venation, and pretarsal claws minute and simple are typical of the Aulacinae: Electrofoenini (Engel, 2017). Within this tribe, *Electrofoenia* gen. nov. differs from *Exilaulacus* (tentatively placed in Electrofoenini by Turrisi and Ellenberger, 2019) and *Electrofoenus* in the pronotum striate, the more tubular gaster, and the fore wing with 2M+Cu present, 1M about half as long as 1Rs, 2Rs+M distinctly shorter, and 2Rs more than twice as long as 1Rs (thus second submarginal cell distinctly larger; refer to Cockerell, 1917c; Li et al., 2018). It is more similar to *Electrofoenops* in the presence of vein 2M+Cu and 2m-cu meeting second submarginal cell after midlength. But *Electrofoenia jehani* differs from *Electrofoenops* in the fore wing vein 2Rs more than twice as long as 1Rs (vs. sub-equal); 2Rs+M short (vs. long); pronotum transversely striate; and mandibles bidentate (vs. pronotum apparently smooth and mandibles tridentate; see Engel, 2017).

Key to the genera of Electrofoenini (modified from Engel, 2017):

1. Fore wing with lcu-a basad M-Cu split, thus short 2M+Cu present; 2m-cu meeting second submarginal cell after midlength ……..…… 2

– Fore wing with lcu-a confluent with M-Cu, thus 2M+Cu absent ……. 3

2. Fore wing vein 1Rs as long as 2Rs; vein 2Rs+M long; mandible tridentate; pronotum smooth …….. *Electrofoenops* Engel

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– Fore wing vein 1Rs twice as short as 2Rs; vein 2Rs+M short; mandible bidentate; pronotum transversely striate …….…… *Electrofoenia* gen. nov.

3. 2m-cu meeting second submarginal cell before midlength; mandible stout, projecting …….. *Electrofoenus* Cockerell

– 2m-cu meeting second submarginal cell after midlength; mandible relatively short ….. …… *Exilaulacus* Li, Shih & Ren

4. Discussion

The new genera and species described herein extend the fossil record of Praeaulacidae and Aulacidae, which now comprise 65 species in 20 genera (all extinct, see Table 1) and 22 fossil species in 12 genera, respectively (see Turrisi and Ellenberger, 2019: Appendix A). The Praeaulacidae were known only from Jurassic and Cretaceous compression fossils until recently, but remarkably the latest findings in Burmese amber have revealed the first and only Cretaceous record of the Nevaniinae and Praeaulacinae. Aulacidae are more widespread and known by extant, Cenozoic and Mesozoic species. In the Aulacinae, only the tribe Electrofoenini is known from Burmese amber, now with three genera and five species.

The mid-Cretaceous Burmese amber shows a rich and unique diversity of Evanioidea, with mostly genera that have not been found in any other fossil deposit. The absence of shared genera with other Cretaceous amber deposits is particularly intriguing, and contrasts with Cenozoic records. For example, *Pristaulacus* shows a wide distribution during the Eocene with fossils from Baltic amber and the USA (Brues, 1910, 1923, 1933; Cockerell, 1916a; Jennings and Krogmann, 2009); and *Aulacus* species have been recorded in amber from France and Baltic area during the Eocene (Brues, 1933; Nel et al., 2004). Unlike these genera,

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the Burmese amber aulacids seem to have a local distribution, either due to the lack of information in the fossil record or an endemism related to the island situation of the Burma Terrane during the mid-Cretaceous (Rasnitsyn and Öhm-Kühnle, 2018; Westerweel et al., 2019). Similarly, the praeaulacid genera from Burmese amber are unique, hitherto known only from this deposit.

The Cretaceous record of evanioids is comparatively similar to that of the Ichneumonoidea (100 species each according to www.fossilworks.org). The latter are much more diverse today, suggesting a shift in the evanioids and ichneumonoids between the mid-Cretaceous and the Cenozoic.

5. Conclusions

The numerous studies on Burmese amber during the last twenty years have dramatically increased our knowledge on the mid-Cretaceous entomofauna. The Evanioidea do not escape this general tendency, with a significant amount of specimens of this superfamily (Zhang et al., 2018; Ross, 2019; Turrisi and Ellenberger, 2019). The two newly described genera emphasize the tremendous evanioid diversity that occurred during the Cretaceous. It is likely that this will be complemented by further discoveries in well known or recently found amber deposits of Cretaceous or even Cenozoic age (e.g., Ethiopia, Congo, China, India), providing essential paleobiogeographical elements for the evolutionary history of the group.

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Table 1. Diversity and distribution of the family Praeaulacidae.

Figures captions

Fig. 1. *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Habitus in ventral view. B, Habitus in dorsal view. Scale bars: 1 mm.

Fig. 2. *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Details of petiole and wings in dorsal view. B, Head in full face view. Scale bars: 0.5 mm.

Fig. 3. Line drawings of *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Head in full face view. B, Fore and hind wings with nomenclature of cells (in bold) and veins. Scale bars: 1 mm.

Fig. 4. *Electrofoenia jehani* gen. et sp. nov., male, holotype IGR.BU-006. A, Habitus in left lateral view. B, Line drawing of fore wing with nomenclature of cells (in bold) and veins. Scale bars: 0.5 mm (A), 1 mm (B).

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Subfamilies / Genera	Species	Distribution	Age	References
Praeaulacinae				
Archaulacus Li, Shih & Ren	1	China	Middle Jurassic	Li et al., 2014a
Aulacogastrinus Rasnitsyn	1	Kazakhstan	Late Jurassic	Rasnitsyn, 1972, 1983
	3	China	Middle Jurassic	Zhang and Rasnitsyn, 2008
Eosaulacus Zhang & Rasnitsyn	1	China	Middle Jurassic	Zhang and Rasnitsyn, 2008
Evanigaster Rasnitsyn	1	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
Evaniops Rasnitsyn	1	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
Gulgonga Oberprieler, Rasnitsyn & Brothers	1	Australia	Late Jurassic	Oberprieler et al., 2012
Habraulacus Li, Rasnitsyn, Shih & Ren	1	Myanmar	Late Cretaceous	Li et al., 2015
Praeaulacinus Rasnitsyn	3	Kazakhstan	Late Jurassic	Rasnitsyn, 1972, 1973
Praeaulacites Rasnitsyn	5	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
Praeaulacon Rasnitsyn	4	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
Praeaulacops Rasnitsyn	1	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
Praeaulacus Rasnitsyn	6	Kazakhstan	Late Jurassic	Rasnitsyn, 1972
	2	Mongolia	Late Jurassic	Rasnitsyn, 2008
	9	China	Middle Jurassic	Zhang and Rasnitsyn, 2008; Li et al., 2014a, 2018; Li and Shih, 2015
Nevaniinae				
Eonevania Rasnitsyn & Zhang	1	China	Middle Jurassic	Rasnitsyn and Zhang, 2010
Nevania Zhang & Rasnitsyn	8	China	Middle Jurassic	Zhang and Rasnitsyn, 2007; Li et al., 2014b
	1	Kazakhstan	Late Jurassic	Zhang and Rasnitsyn, 2008
Rasnitsevania Jouault, Nel & Perrichot	1	Myanmar	Late Cretaceous	This study
Cretocleistogastrinae				
Cretocleistogaster Rasnitsyn	3	Russia	Late Cretaceous	Rasnitsyn, 1975
Miniwestratia Rasnitsyn	1	Mongolia	Late Cretaceous	Rasnitsyn, 1990a
Nanowestratia Rasnitsyn	1	Russia	Late Cretaceous	Rasnitsyn, 1990a
Sinowestratia Zhang & Zheng	1	China	Late Cretaceous	Zhang & Zheng, 2000
Westratia Rasnitsyn	3	Russia	Late Cretaceous	Rasnitsyn, 1990a, 1990b
	4	Mongolia	Late Cretaceous	Rasnitsyn, 1990a
	1	Australia	Late Cretaceous	Jell & Duncan, 1986

Table 1. Diversity and distribution of the family Praeaulacidae.

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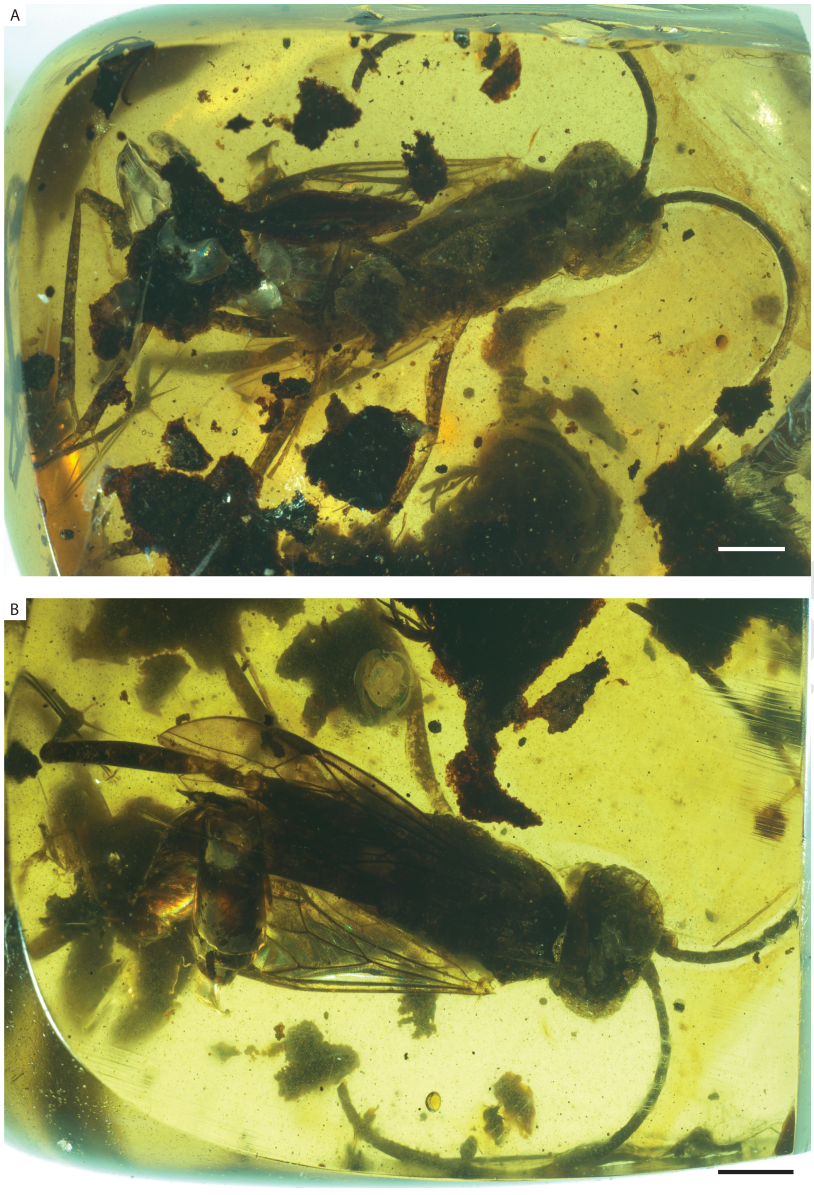
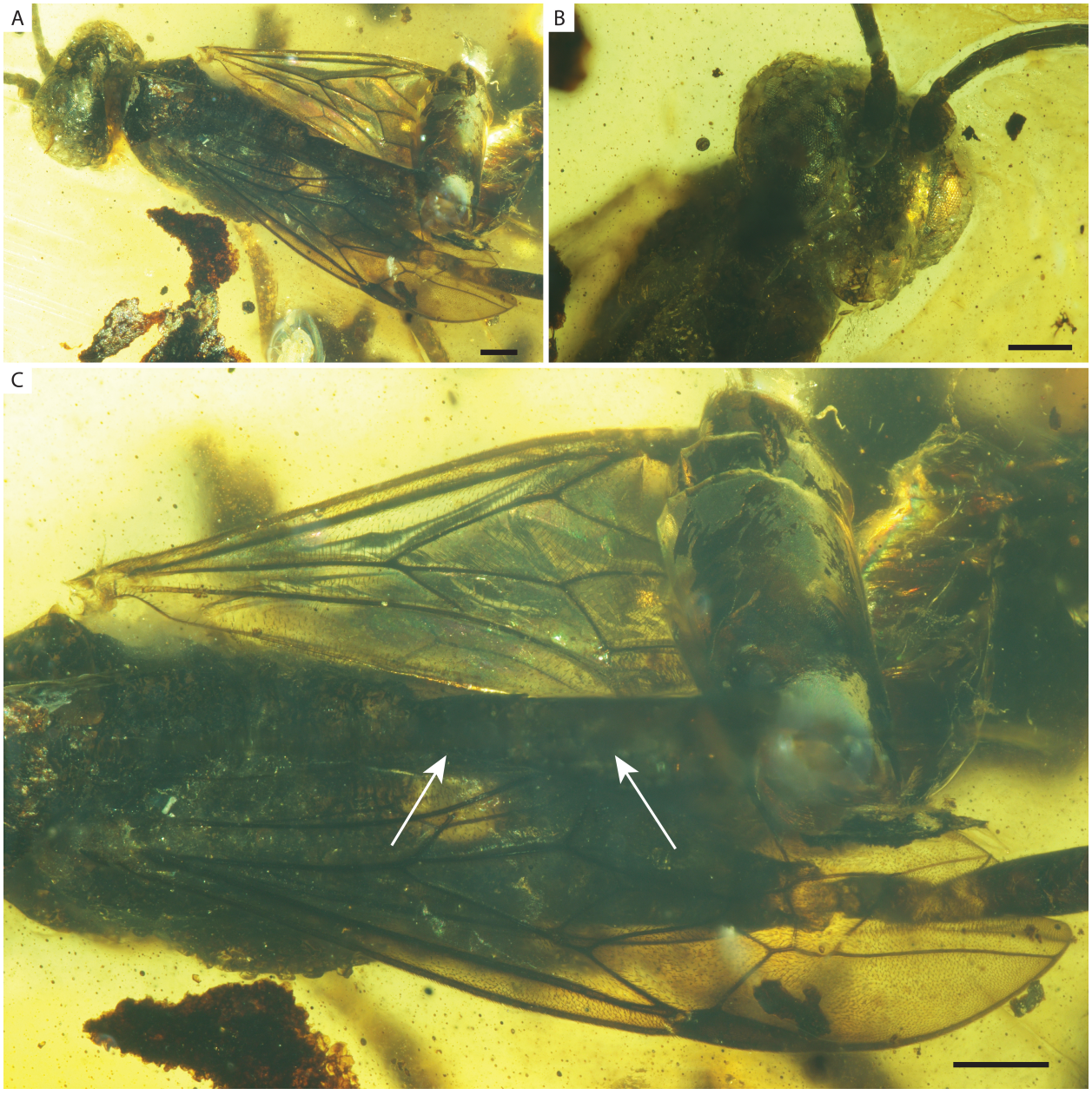
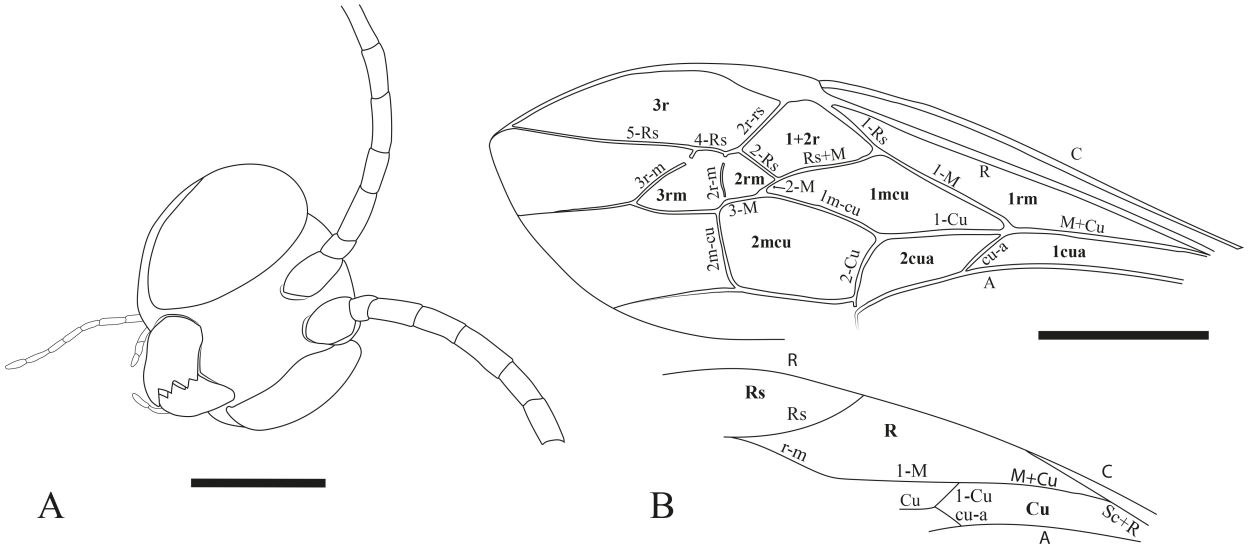


Proof


A
B
C

Journal Pre-proof



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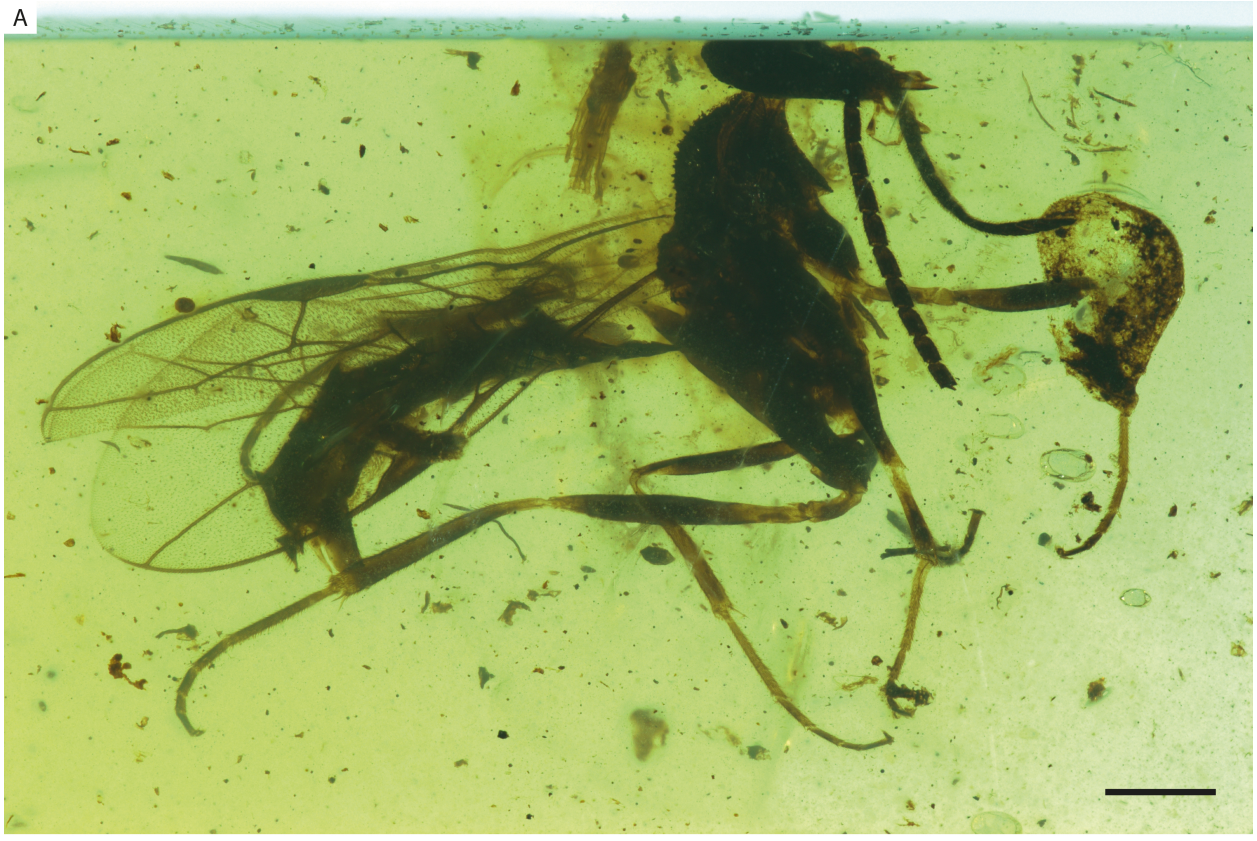
A



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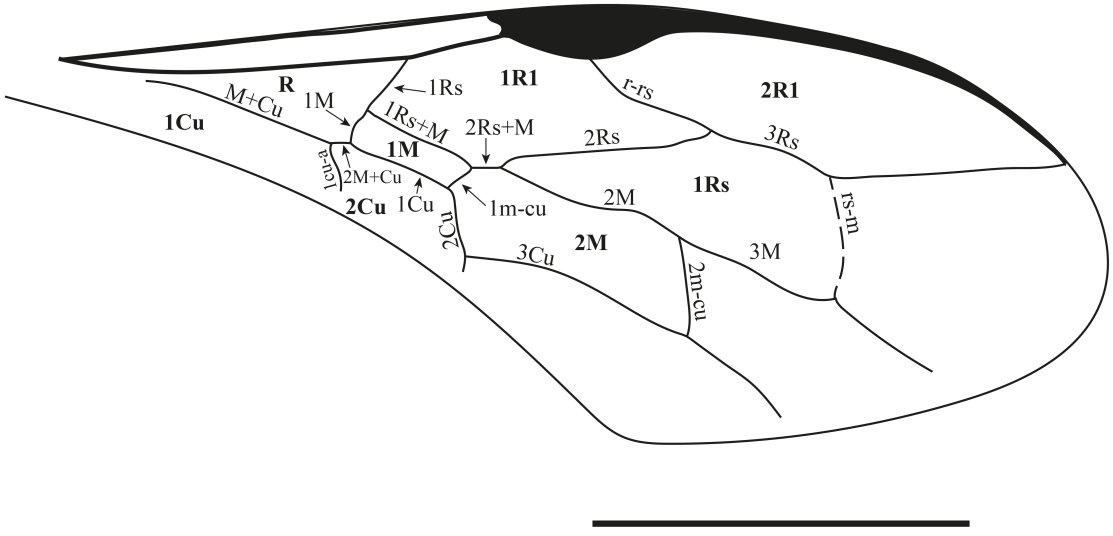
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1Rs
1R1
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2R1
1Cu
1Rs+M
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3Rs
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2M+Cu
2Cu
1Cu
1m-cu
2Cu
2M
1Rs
rs-m
3Cu
2M
3M
2m-cu

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Author statement

Corentin Jouault, Vincent Perrichot: Conceptualization; **Corentin Jouault, André Nel, Vincent Perrichot**: Data curation, Writing- Original draft preparation. **Corentin Jouault, Vincent Perrichot**: Investigation. **Corentin Jouault, André Nel, Vincent Perrichot:** Writing- Reviewing and Editing.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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